



February 17, 2017

Mr. Rick Jardine
U.S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, Georgia 30303

Subject: Phase 3 Removal Depth Sampling Report, Rev. 1
35th Avenue Superfund Site
Technical Direction Document (TDD) No. 0002/OT-02-002
Contract No. EP-S4-15-01

Dear Mr. Jardine:

Oneida Total Integrated Enterprises (OTIE), Superfund Technical Assessment Response Team (START), has completed Revision 1 of the Phase 3 Removal Depth Sampling report for the 35th Avenue Superfund site in Jefferson County, Birmingham, Alabama.

Please contact me at (678) 355-5550 if you have any questions or comments. We have appreciated the opportunity to complete this removal investigation.

Sincerely,

Russell Henderson
START Senior Scientist
Project Manager

Enclosure

cc: Katrina Jones, EPA Project Officer
Greg Kowalski, START Program Manager (w/o enclosure)
START File

**PHASE 3
REMOVAL DEPTH SAMPLING REPORT**

**35TH AVENUE SUPERFUND SITE
BIRMINGHAM, JEFFERSON COUNTY, ALABAMA**

Revision 1

Prepared for:

**U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 4
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EXECUTIVE SUMMARY

Oneida Total Integrated Enterprises (OTIE), Superfund Technical Assessment and Response Team (START), conducted Depth Sampling in support of Phase 3 of the Time-Critical Removal Action (TCRA) at the 35th Avenue Superfund Site, located in Birmingham, Jefferson County, Alabama (the site). The study area for the site encompasses approximately 2,060 residential and residential-use (childcare facilities; church playgrounds; City Parks and playgrounds; and schools) parcels located in the neighborhoods of Fairmont, Collegeville, and Harriman Park. The extent of the study area encompasses the area south of 49th Street, east of 26th Street/Highway 31, north of 27th Avenue, and west of the railroad lines. It is a mixture of residential properties surrounded by industrial facilities historically associated with limestone quarry operations, foundries, recycling, and coke and chemical manufacturing operations. Previous investigations have shown elevated levels of polycyclic aromatic hydrocarbons (PAH), arsenic, and lead in surficial soils. Unless specifically identified in this report, the residential and residential-use parcels located within this boundary will be collectively referred to as “35th Avenue Superfund Site”.

Phase 3 TCRA Depth Sampling (“the work”), conducted under Contract Number (No.) EP-S4-15-01, Technical Direction Document (TDD) No. 0002/OT-02-002, included soil sampling at 32 residential-use properties where previous sampling by EPA Emergency Response, Removal, and Protection Branch (ERRPB) indicated levels of PAH and/or arsenic in the surficial soils exceeding 2xs the 10-4 and/or HQ=1 risk levels for direct contact with residential soil [3.0 milligrams per kilogram (mg/kg) for PAH, 61 mg/kg for arsenic] or lead in surficial soils exceeding 400 mg/kg. One additional property was included at the time of the investigation because it was located adjacent to, and provided access for, a property in the Phase 3 TCRA.

This Depth Sampling Report summarizes relevant data and findings of the field investigation activities conducted by START from January 5, 2015 through May 19, 2015.

A total of 189 soil samples (165 field samples and 24 field duplicates) were collected and submitted TestAmerica Laboratories (TestAmerica) in Savannah, Georgia, for arsenic, lead, and low-level PAH analysis. Some samples were also analyzed for aluminum and iron. One sample was collected from surficial depths in order to confirm removal investigation results. All other samples were collected from the 6-inch, 12-inch, 18-inch, and 24-inch below ground surface (bgs) depths.

Geologic soil logs were prepared for most of the samples collected for this phase of the project. Photos were taken of each of the sample aliquots laid out on plastic sheeting in order and by depth interval. This was done in order to ascertain if correlations could be made from soil type and appearance to analytical data results.

The soil types in the properties at the 35th Avenue Superfund Site were found to be extremely varied and non-homogenous. It was determined in the early stages of the project that many of the properties had imported local fill material from a variety of sites including but not limited to stockpiles from current or previously operating industries such as foundries, manufacturing plants, and steel production facilities. The soils ranged from dark silty loam to reddish orange clay at depth; often containing slag, foundry sand, coal, construction debris, metal, and plastics. The reddish orange clay appears to be native to the geology of the area.

Analytical data showed detected concentrations of arsenic and lead in 100% of the samples with concentrations ranging from 3.6 mg/kg to 150J mg/kg and 7.3 mg/kg to 6,200J mg/kg, respectively. PAH compounds, primarily benzo(a)pyrene, were detected in 93% of the samples analyzed with concentrations ranging from 0.0015J mg/kg to 17 mg/kg. Calculated benzo(a)pyrene (BaP) equivalent values ranged from 0.0069 mg/kg to 23.3 mg/kg.

Every effort was made to establish a correlation between the observed soil types and the analytical results, but due to the non-homogeneity of the soils at the site, no such determinations could be made except in the presence of aromatic coke slag, which tended to yield large PAH concentrations.

The analytical data gathered during this field investigation provides EPA with information to determine an appropriate depth which removal could be conducted at 45 locations comprising the 33 parcels identified for Phase 3 TCRA.

1.0 SCOPE

1.1 OVERVIEW

Oneida Total Integrated Enterprises (OTIE), Superfund Technical Assessment and Response Team (START), was tasked by the U.S. Environmental Protection Agency (USEPA) Region 4 to perform Depth Sampling in support of Phase 3 of the Time-Critical Removal Action (TCRA) at the 35th Avenue Superfund Site, located in Birmingham, Jefferson County, Alabama. The general purpose of a Removal Action (RA) under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) is to eliminate or minimize potential threats to human health or the environment, with regards to a release of a hazardous substance, pollutant, or contaminant. The scope of this investigation was to conduct sampling and analysis activities to identify the vertical extent of arsenic, lead, and/or polycyclic aromatic hydrocarbon (PAH) contamination at 32 parcels residential-use properties where previous sampling by EPA Emergency Response, Removal, and Protection Branch (ERRPB) indicated levels of PAH and/or arsenic in the surficial soils exceeding 2xs the 10-4 and/or HQ=1 risk levels for direct contact with residential soil [3.0 milligrams per kilogram (mg/kg) for PAH, 61 mg/kg for arsenic] or lead in surficial soils exceeding 400 mg/kg. The work was conducted under Contract Number (No.) EP-S4-15-01, Technical Direction Document (TDD) No. 0002/OT-02-002.

The work performed under this phase of the project has consisted of START (OTIE) personnel developing a Quality Assurance Project Plan (QAPP)/Site Sampling Plan (SSP) that described site-specific sampling and analysis procedures and quality assurance measures, documenting field investigation activities with logbook notes and digital photographs, collecting soil samples from each location, submitting samples for laboratory analyses, performing data validation of the analytical results, and compiling environmental data into a EPA Scribe© database. All activities and procedures conducted by START were performed in accordance with the EPA Region 4 Science and Ecosystem Support Branch (SESD) Field Branches Quality System and Technical Procedures (FBQSTP) and the site-specific QAPP/SSP verbally approved on July 7, 2014 (Refs. 1; 2).

This Depth Sampling Report summarizes relevant data and findings of the field investigation activities conducted by START from January 5, 2015 through May 19, 2015. It provides information used to assess the vertical extent of contamination (up to 24 inches below ground surface [bgs]) on those properties identified for Phase 3 TCRA. The analytical data gathered during this field investigation will provide EPA with information to identify an appropriate depth at which removal may be conducted at the individual properties assessed.

1.2 PROJECT APPROACH

The study area for the site is a mixture of residential properties surrounded by industrial facilities historically associated with limestone quarrying, foundries, recycling, and coke and chemical manufacturing operations. It encompasses approximately 2,060 residential and residential-use (childcare facilities; church playgrounds; City Parks and playgrounds; and schools) parcels located south of 49th Street, east of 26th Street/Highway 31, north of 27th Avenue, and west of the railroad lines (Figures 1 and 2, Appendix A).

Previous investigations at the site indicate the presence of elevated levels of carcinogenic polycyclic aromatic hydrocarbons (cPAH), arsenic, and lead in the surface soils of residential properties (see Section 2.2). The purpose of this phase of the USEPA ERRPB investigation was to determine the vertical extent of contamination in the soil at the 32 residential-use properties previous sampling by EPA ERRPB indicated concentrations exceeding 3.0 milligrams per kilogram (mg/kg) for PAH, 61 mg/kg for arsenic, or 400 mg/kg for lead (Table 1, Appendix B). Soils from selected properties were sampled from four distinct depth intervals (up to 24 inches bgs) and submitted to TestAmerica Laboratories (TestAmerica) in Savannah, Georgia, a National Environmental Laboratory Accreditation Conference (NELAC) certified laboratory, for arsenic, lead, and low-level PAH analysis. Some samples were also analyzed for aluminum and iron.

Figures 3-1 through 3-13 presented in Appendix A show the parcels and locations sampled as part of this investigation.

1.3 REPORT ORGANIZATION

The site background information that guided the sampling approach is presented in Section 2. The procedures of the sampling and analyses are summarized in Section 3. Specific details on sampling and analyses for this site are provided in the QAPP/SSP (Ref. 2). The results of the sampling and analyses are provided in Section 4. Final conclusions are discussed in Section 5. References are cited throughout the report to substantiate site-specific statements. A reference list is provided in Section 6.0.

Figures and summary tables are provided as Appendices A and B, respectively. A photographic log for the depth sampling is provided as Appendix C and copies of the field logbook notes are presented as Appendix D. The analytical reports generated by the laboratory, as well as the Data Validation summaries prepared by START chemists, are provided as Appendix E.

2.0 BACKGROUND

The following presents the site description, background historical information, and surrounding area descriptions used to guide selection of sample locations and analytical methodology for potential contaminants of concern.

2.1 SITE DESCRIPTION

The site encompasses three residential neighborhoods: Fairmont, Collegeville, and Harriman Park, in Birmingham, Jefferson County Alabama (Appendix A, Figure 2). The geographic coordinates for the approximate center of the site are 33.561625 North latitude and -86.802568 West longitude. The Fairmont neighborhood comprises the western portion of the site, Collegeville the southern portion, and Harriman Park the eastern portion. An active coke manufacturing facility is located in the center of the study area but was not included as part of this investigation.

Residential dwellings and Hudson School in the Collegeville neighborhood were present in 1929 based on a review of a Sanborn Fire Insurance Map for the same year (1929, V. 9, Sheets 953 and 954). The Harriman Park neighborhood was constructed in the early 1950's based on a review of the 1951 aerial photograph of North Birmingham (CPM 6H-25). Construction of residential dwellings in the Fairmont neighborhood appear to have begun as late as 1951 and continued through the late 1970's (Ref. 3).

The site lies within the Birmingham Valley District of the Alabama Valley and Ridge Physiographic section (Appendix A, Figure 1). The Birmingham Valley is bounded by Sands Mountain to the northwest and Red Mountain to the southeast. Elevations at the site range from approximately 650 feet above mean sea level (amsl) in the Fairmont neighborhood to 560 feet amsl in Harriman Park.

According to the Federal Emergency Management Agency (FEMA), a large portion of the Collegeville neighborhood is located in a 100-year flood plain (Flood Plain Panel 01073C).

2.2 SITE HISTORY

In April 2005, CH2MHill, on behalf of Sloss Industries (Sloss), conducted supplemental off-site soil sampling as part of an effort to complete Environmental Indicator (EI) determinations at the Sloss Industries facility (currently ERP Compliant Coke). One surface soil sample (0- to 2-foot interval) was collected from each of 35 properties (homes, schools, and a park) within residential areas adjacent to the facility. The analytical results showed elevated concentrations of individual cPAHs and arsenic in several soil samples. CH2MHill concluded that off-site soils were affected by benzo(a)pyrene and that the concentrations of benzo(a)pyrene decreased with

increasing distance from the Sloss facility. However, because low-level PAH concentrations are anthropogenic (associated with urban environments), they recommended that background soil samples be collected from undisturbed locations, unaffected by the site, in order to assess the natural concentrations of PAHs in the general area. They also concluded that the elevated concentrations of arsenic detected in off-site soils were generally naturally occurring (Ref. 4).

In July 2009, CH2MHill, on behalf of Walter Coke (formerly Sloss), assessed the surface soils at 65 residential properties, a Public Housing, a right-of-way, a church, a drainage ditch from the Walter Coke property to Harriman Park, an off-site Walter Coke property, and four schools (the former Carver High School, the former Hudson School, Riggins Alternative School, and the Calloway Head Start School) as part of a voluntary cooperation effort between the USEPA Resource Conservation and Recovery Act (RCRA) and Walter Coke, Inc. Results indicated that surface soils at portions of 23 of the properties exhibited benzo(a)pyrene toxicity equivalence (BaP TEQ) values exceeding 1.5 mg/kg and/or sieved arsenic values exceeding 37 mg/kg (Ref. 5).

In September 2010, USEPA SEDS conducted background sampling in and around the Robinwood Neighborhood in response to Walter Coke's position that the PAHs detected in residential soil samples they collected in 2005 and 2009 are the result of years of contribution from multiple sources, both non-industrial and industrial; and, in the case of arsenic, naturally occurring in the rock and soil. Twenty (20) sample locations were selected and sampled in and around the Robinwood area ranging from 4.5 to 9 miles northeast of Walter Coke. Thirteen of the locations had BaP TEQ values less than 0.1 mg/kg; four locations had BaP TEQ values between 0.1 mg/kg and 0.5 mg/kg; two locations had BaP TEQ values between 0.5 mg/kg and 1.0 mg/kg; and one location had a BaP TEQ greater than 1.0 mg/kg (1.1 mg/kg). All but one location had surface soil arsenic concentrations below 6 mg/kg (Ref. 6).

Because Hudson School was under construction during the 2009 sampling event, Walter Coke elected to resample soil at the school property in September 2010 after construction of the new school was completed. Five point composite surface soil samples were collected from 14 areas (each consisting of ¼ to ½ acre) on the new Hudson School property. Three of the 14 locations had BaP TEQ greater than 1.5 mg/kg (Ref. 7).

In January 2011, CH2MHill submitted to Walter Coke a Technical Memorandum summarizing the work to remove soils contaminated with cBaP at Riggins School and Hudson School (Ref. 8). Following receipt of School Board approvals and access, work began at Hudson School on March 10, 2011, and site restoration was completed on June 8, 2011. Approximately 52,000 cubic feet of soil were removed from the Hudson School property and replaced with imported backfill. Surface soil was removed to a depth of 2 feet bgs (Ref. 9). There is no file material available to document a removal at the Riggins School.

In June 2011, CH2M Hill, on behalf of Walter Coke, submitted a Remedial Action Work Plan to remove residential surface soils identified as exceeding the USEPA's cleanup levels at 23 residential properties located within the Harriman Park and Collegeville neighborhoods pursuant to agreements reached between Walter Coke and USEPA RCRA Region 4 (Ref. 10). Removal activities, including the excavation and replacement of soils with clean fill were completed at 16 of the 23 properties. The remaining 7 properties declined access (Ref. 11).

From November 2012 through June 2013, the surface soils of 1,116 residential and residential-use parcels were sampled as part of the EPA ERRPB Removal Investigation. Sampling was conducted to identify the nature and extent of contamination in the surface soils (0-4 inches bgs) of parcels located within the study boundary of the site. A total 3,160 (2,976 composite and 184 grab) surface soil samples were collected primarily for PAH and RCRA metals analysis. Field samples were screened ex situ for RCRA metals concentrations using a Niton XL3t X-Ray Fluorescence (XRF) instrument to efficiently identify properties with elevated concentrations in soil. A portion of 1,823 field samples were sieved using a 2-millimeter sieve, and screened in order to assess the lead uptake of the contamination. Of the 3,160 soil samples collected, all but three were analyzed for target compound list (TCL) PAH. XRF field screening results and laboratory analytical data showed arsenic and/or lead concentrations exceeding the Removal Management Levels (RMLs) dated July 2012 for direct contact with residential soil in 450 locations in 324 parcels. Analytical data show elevated levels of PAHs, primarily benzo(a)pyrene, at concentrations exceeding the RML of 1.5 mg/kg in 145 locations in 102 parcels (Ref. 3).

On September 25, 2013, EPA issued an Action Memorandum requesting a TCRA at the 35th Avenue Site (Ref. 12). The proposed action included excavation of contaminated soils up to 12 inches bgs at those parcels that far exceed the RML (last update: December 2012). A second Action Memorandum was issued on March 12, 2014 that identified an amended scope of work to allow for an expanded lateral and vertical excavation of contaminated soil to a maximum excavation depth up to 24 inches bgs. The purpose for the amendment was to minimize disruption of impacted community members while optimizing use of government resources (Ref. 13).

From February 18, 2014 through May 19, 2015, the removal investigation field investigation was expanded to include 19 properties where access was granted by the property owner following the completion of the November 2012 through June 2013 ERRPB Removal Investigation. Activities included the collection of 46 composite surface soil samples (0-4 inches below ground surface) from 39 locations to assess whether PAHs, arsenic, or lead contamination was present at concentrations exceeding site-specific Cleanup Goals. Analytical data showed elevated levels of benzo(a)pyrene, calculated BaP TEQ, and lead in 6 locations comprising 5 parcels (Ref. 15).

2.3 REGIONAL GEOLOGY

The site is located within the Valley and Ridge physiographic province of the State. More specifically, the site is within the Birmingham-Big Canoe Valley District with elevations ranging from approximately 500 feet in Jefferson County to approximately 600 feet in neighboring St. Clair County. The geology and physiography of this province is quite complex because the region was strongly affected by large-scale tectonic activity during the Appalachian orogeny. The site is in the Appalachian fold and thrust belt, consisting of shallow marine to deltaic Paleozoic sedimentary strata deposited on a continental platform. Regionally, strata generally strike to the northeast-southwest with southeast dip. Across strike, the fold and thrust belt is characterized by folds associated with large thrust-fault ramps. Regionally, the ridges dividing the valleys and the rock types that cap them are as follows: Weisner ridges, quartzite; western edge of the Northern Piedmont, slate; Cahaba ridges, sandstone and conglomerate; and Blount Mountain, sandstone. These rocks are highly resistant to weathering, are not significantly faulted, and are relatively impermeable (Ref. 14).

2.4 HYDROGEOLOGY

The site is underlain by the Valley and Ridge aquifer system. The Valley and Ridge aquifer system is comprised of aquifers consisting of limestone, sandstone, and fractured rock that are exposed in valleys and separated by ridges. The complex geologic structure of the area has caused regional discontinuity of rock units so major aquifers or aquifer systems are not continuous. A given major aquifer may be present in adjacent valleys; however, the two valleys may not be hydraulically connected due to faulting or folding. The water-bearing formation within the aquifer system at the site is the Conasauga Formation. Limestone of the Conasauga Formation in the Birmingham-Big Canoe Valley yields substantial amounts of water where the dominantly calcareous and steeply dipping strata contain well-developed dissolution channels. Groundwater flow is primarily from the higher altitudes adjacent to the ridges toward the center of the valleys. In addition, ground water moves "down valley" in the direction of streamflow. Groundwater recharge is through the infiltration of precipitation, mostly rain supplemented by occasional snow. Most other rock units of Cambrian to Devonian age are included within the Valley and Ridge aquifer system because they do not form effective barriers to ground water movement among permeable units of the Valley and Ridge aquifer system. However, these other units also are not significant sources of ground water (Ref. 14).

3.0 CHARACTERIZATION METHODS AND PROCEDURES

The following sections describe the field investigation activities, data analyses, and data validation procedures used to obtain the results of this phase of depth sampling.

3.1 SAMPLE LOCATION DETERMINATION

A total of 32 parcels (42 locations) were identified for this phase of depth sampling where previous sampling by EPA ERRPB indicated levels of PAH, arsenic, and/or lead in the surficial soils exceeding 2xs 10⁻⁴ and/or HQ=1 risk levels for direct contact with residential soil. Table 1 provided in Appendix B summarizes the surface soil exceedances for the parcels selected for Phase 3 TCRA depth sampling.

One additional property (CV-0225) was included in the Phase 3 TCRA depth sampling event at the time of the investigation. This property provides access to an adjacent property where contaminant concentrations indicated TCRA removal action would be needed.

One additional location, backyard for property CV-0162 (CV0162B), was resampled surficially only to confirm removal investigation results.

Samples were collected from the same aliquot locations sampled during the removal investigations (Refs. 3; 15). Each field sampling team used a Trimble® Global Positioning System (GPS) instrument equipped with ESRI ArcMap® to navigate to each of the geographic coordinates for surface soil aliquots sampled during the removal investigations. Table 2 provided in Appendix B, presents a listing of the geographic coordinates for each location assessed during this sampling event.

3.2 GENERAL SAMPLE COLLECTION PROCEDURES

From January 5 through May 19, 2015, START field team personnel collected a total of 189 soil samples (165 field samples and 24 field duplicates) from 33 parcels (45 locations) at the site. A summary of the samples collected and the analyses performed is presented in Table 3 provided in Appendix B. All field observations and descriptions, including soil type classification, were recorded with digital photographs (Appendix C) and in the logbook (Appendix D).

All but one soil sample were collected from the 6-inch, 12-inch, 18-inch, and 24-inch bgs depths at each aliquot location to assess vertical extent of contamination. Sample CV0162B-CSD-4 was collected from 0-4 inches bgs to confirm removal investigation results.

Where encountered, sod or grass turf was first scraped off with a flat shovel prior to sampling. A clean and decontaminated hand auger bucket was used to auger to 6 inches bgs at each aliquot point for a sample. Once the sampling depth was reached, a second clean and decontaminated auger bucket was used to collect sample material from each aliquot comprising the 6-inch depth composite sample. Following sample collection, the same auger bucket was used to auger down to 12-inch sampling depth. Once that sampling depth was reached, a third clean and decontaminated auger bucket was used to collect sample material from 12-inch depth. The process of hand augering to the desired depth and using a clean and decontaminated auger bucket to collect the sample was repeated for the 18- and 24-inch depth samples.

Soil from each aliquot at each sample depth was placed on dedicated plastic sheeting and logged with photographs and notes. The aliquots for each depth sample were then homogenized in a stainless steel bowl using a stainless steel spoon, and containerized for laboratory analysis. Sampling jars were filled with the minimum soil volume needed to conduct the necessary analysis. Any remaining sample volume, and scraped sod or grass turf, was returned to the individual aliquot points.

Auger refusal was sporadically encountered at varying depths throughout the site. In response to field conditions, the exact number of aliquots per sample was determined in the field. Table 3 provided in Appendix B presents the number of aliquots comprising each composite sample.

3.3 SAMPLE ANALYSES

All soil samples were analyzed in accordance with the data quality objectives (DQOs) described in approved QAPP/SSP for this phase of the project (Ref. 2). Samples were submitted to TestAmerica Laboratories for low level PAH analysis in accordance with SW846-8270D, and total lead and arsenic analysis in accordance with SW846-6010C. In order to assess the effect of aluminum and iron on ICP lead and arsenic analysis, 136 samples were also analyzed for total aluminum and iron.

Table 3 provided in Appendix B presents the analyses performed for each sample collected.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of sampling equipment, glassware, and reagents. This section describes the QA/QC measures taken and provides an evaluation of the usability of data presented in this report.

All samples were collected in accordance with the approved site-specific QAPP (Ref. 2).

4.1 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

QA samples including rinsate blanks were collected to assess adequacy of decontamination procedures. A total of four equipment rinsate blanks were collected during this depth sampling effort.

QC samples, including matrix spike (MS)/matrix spike duplicate (MSD) and field duplicate (DUP) samples, were collected at a rate of one MS/MSD per 20 samples per analysis, and one DUP per 10 samples per analysis. Fifteen (15) samples were selected for MS/MSD analysis and 24 field duplicate pairs were collected for precision determination.

A START chemist validated TestAmerica's data based on QC sample results in accordance to criteria presented in the approved site-specific QAPP. Rinsate blanks and MS/MSDs were assessed in accordance with the National Functional Guidelines (NFG). Field duplicate samples were assessed based on a 50% relative percent difference of each other. Section 4.3 details data quality and includes QA/QC assessments.

4.2 LABORATORY ANALYSIS

One-hundred and eighty-nine (189) samples were submitted to NELAC Institute certified laboratory TestAmerica Laboratories, Inc. of Savannah, GA for laboratory analysis. Samples were analyzed for PAH, arsenic, and lead; and in some cases aluminum and iron.

The laboratory project numbers for each of the samples analyzed by analysis is presented in Table 3 provided in Appendix B.

4.3 START DATA VALIDATION

The data for samples submitted to TestAmerica were reviewed by START in general accordance with the USEPA "Contract Laboratory Program (CLP) NFG for Organic Methods Data Review" dated October 1999, USEPA CLP NFG for Low Concentration Organic Methods Data Review dated June 2001, and USEPA CLP NFG for

Inorganic Data Review dated October 2004. Sample results were qualified based on the results of the data review. Criteria for acceptability of data were based upon available site information, analytical method requirements, guidance documents, and professional judgment.

Organic data validation consisted of a review of the following quality control (QC) parameters: holding times, instrument performance checks, initial and continuing calibrations, surrogate recoveries, blank results, MS/MSD results, laboratory control sample (LCS) results, internal standard response, and target compound identification and quantitation.

Inorganic data validation consisted of a review of the following QC parameters: holding times, initial and continuing calibrations, blank results, inductively coupled plasma interference check sample results, LCS results, post digestion spike results, serial dilution results, duplicate sample results, MS/MSD results, and sample result quantitation.

In the text and analytical data tables in this report, some concentrations of organic and inorganic parameters are qualified with a “J”. A “J” qualifier indicates that the qualitative analysis is acceptable; although the quantitative value is only estimated. Results of some sample analyses are qualified with a “U”, meaning that the constituent was analyzed for but not detected. The reported number is the laboratory-derived sample quantitation limit (SQL) for the constituent in that sample. A “UJ” qualifier indicates that the constituent was analyzed for but not detected, and the reported quantitation limit is approximate and may be inaccurate or imprecise.

Overall, the sample analytical data generated by TestAmerica are acceptable for use as qualified by START chemists based on criteria for acceptability of data described in the CLP NFG, analytical methods, guidance documents, and professional judgement. Electronic copies of the START Data Validation Memos prepared for each of the packages are included in Appendix E.

5.0 RESULTS

The following sections summarize the field investigation results.

5.1 FIELD OBSERVATIONS

Geologic soil logs were prepared for most of the samples collected at the site for this phase of the project. Photos were taken of each of the sample aliquots laid out on plastic sheeting in order and by depth interval. This was done in order to ascertain if correlations could be made from soil type and appearance to analytical data results.

The soil types in the properties at the 35th Avenue Superfund Site were extremely varied and non-homogenous. It was determined in the early stages of the project that many of the properties had imported local fill material from a variety of sites including but not limited to stockpiles from current or previously operating industries such as foundries, manufacturing plants, and steel production facilities. The soils ranged from dark silty loam to reddish orange clay at depth; often containing slag, foundry sand, coal, construction debris, metal, and plastics. The reddish orange clay appears to be native to the geology of the area.

Detailed descriptions of the field observations are provided on the logbook notes located in Appendix D. These field notes, even when combined with the photos and analytical data, does not necessarily confirm the presence or absence of contamination. Every effort was made to establish a correlation between these elements, but due to the non-homogeneity of the soils at the site, no such determinations could be made except in the presence of aromatic coke slag, which tended to yield large PAH concentrations.

5.2 ANALYTICAL RESULTS

A total of 189 soil samples were submitted to laboratory for low-level PAH, arsenic, and lead analysis. A subset of the samples were also analyzed for aluminum and iron.

cPAH compounds benzo(a)pyrene were detected in 93% of the 189 samples analyzed for LL-PAH. Concentrations ranged from 0.0015J mg/kg to 17 mg/kg. Benzo(b)fluoranthene was detected in 89% of the samples with concentrations ranging from 0.0044J mg/kg to 24J mg/kg. Benzo(k)fluoranthene was detected in 83% of the samples with concentrations ranging from 0.0024J mg/kg to 11J mg/kg. Benzo(a)anthracene and chrysene were detected in 80% of the samples with concentrations ranging from 0.0042J mg/kg to 24J and 25J mg/kg for benzo(a)anthracene and chrysene, respectively. The remaining cPAH, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene, were detected in 57% and 74% of the samples respectively. Concentrations ranged from

0.0044J mg/kg to 2.3 mg/kg for dibenz(a,h)anthracene and 0.004J mg/kg to 7.5J mg/kg for indeno(1,2,3-cd)pyrene.

Non-carcinogenic PAH compounds detected in soil samples include 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene. These compounds were detected in over half of the samples. Concentrations ranged from 0.0041J mg/kg to 1.9 mg/kg for 1-methylnaphthalene, 0.0043J mg/kg to 1.9 mg/kg for 2-methylnaphthalene, 0.0042J mg/kg to 2.5J mg/kg for acenaphthene, 0.00041J mg/kg to 0.5 mg/kg for acenaphthylene, 0.0041J mg/kg to 8.5J mg/kg for anthracene, 0.0053J mg/kg to 6.9J mg/kg for benzo(g,h,i)perylene, 0.0039J mg/kg to 53J mg/kg for fluoranthene, 0.0042J mg/kg to 2.8J mg/kg for fluorene, 0.005J mg/kg to 2.3 mg/kg for naphthalene, 0.003J mg/kg to 36J mg/kg for phenanthrene, and 0.0044J mg/kg to 50J mg/kg for pyrene.

Arsenic and lead were detected in 100% of the soil samples at concentrations ranging from 3.6 mg/kg to 150J mg/kg and 7.3 mg/kg to 6,200J mg/kg, respectively.

Laboratory analytical results for soil samples are provided in Tables 4 to 6 located in Appendix B. The summarized laboratory analytical reports are provided in Appendix E. Full analytical data packages are provided.

6.0 SUMMARY AND CONCLUSIONS

Soil sampling events in support of the Phase 3 TCRA were performed at the site from January 5, 2015 through May 19, 2015. Sampling was conducted at 32 residential-use properties where previous sampling by EPA ERRPB indicated levels of PAH, arsenic, and/or lead in the surficial soils exceeding the 2xs 10⁻⁴ and/or HQ=1 risk levels for direct contact with residential soil. One additional property (CV-0225) was also depth sampled at the time of the investigation. This property provides access to an adjacent property where contaminant concentrations indicated TCRA removal action would be needed.

A total of 189 soil samples (165 field samples and 24 field duplicates) were collected from 45 locations. All but one sample were collected at the same aliquot points sampled during the EPA ERRPB Removal Investigation from the 6-inch, 12-inch, 18-inch, and 24-inch bgs depths. One sample was collected from 0-4-inch bgs depth interval to confirm removal investigation results.

Samples were submitted to TestAmerica Laboratories for low level PAH analysis in accordance with SW846-8270D, and total lead and arsenic analysis in accordance with SW846-6010C. A subset of the samples were also analyzed for aluminum and iron in order to assess their effect on ICP lead and arsenic analysis.

Analytical data showed detected concentrations of arsenic and lead in 100% of the samples.

Analytical data showed detected concentrations of PAH compounds, primarily benzo(a)pyrene, in 93% of the samples analyzed. Additional cPAH were detected in a majority of the samples, therefore to simplify PAH evaluation, the benzo(a)pyrene (BaP) equivalent was also calculated. It is based on the EPA 1993 toxicity equivalency factors and the concentrations of the seven individual cPAHs. The BaP equivalent calculation is based on a BaP toxicity equivalence factor multiplied by the concentration of the PAH for each of the following seven carcinogenic PAHs:

$$\text{BaP equivalents} = (0.1) \text{ benzo(a)anthracene} + (1.0) \text{ benzo(a)pyrene} + (0.1) \text{ benzo(b)fluoranthene} + \\ (0.01) \text{ benzo(k)fluoranthene} + (0.001) \text{ chrysene} + (0.1) \text{ indeno(1,2,3cd)pyrene}$$

In general, BaP equivalent values ranged from 0.0069 mg/kg to 23.3 mg/kg.

Geologic soil logs were prepared for each of the samples collected during this phase of work at the site in an effort to ascertain if correlations could be made from soil type and appearance to analytical data results. Due to the non-homogeneity of the soils at the site, no such determinations could be made except in the presence of aromatic coke slag, which tended to yield large PAH concentrations.

The analytical data gathered during this field investigation will provide EPA with information to determine appropriate depth (up to 24 inches below ground surface bgs) at which removal could be conducted at 45 locations comprising the 33 parcels identified for Phase 3 TCRA.

7.0 REFERENCES

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APPENDIX A

FIGURES

APPENDIX B

TABLES

APPENDIX C
PHOTOGRAPHIC LOG

APPENDIX D
LOGBOOK NOTES

APPENDIX E

**DATA VALIDATION MEMORANDUM
AND LABORATORY ANALYTICAL REPORTS**